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Gregor Dudek

Collaborative Planning in Supply Chains

A Negotiation-Based Approach



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Foreword

In light of the vast number of publications on Supply Chain Management (SCM) it is not easy to extract those which will have a great impact both on theory and practice. The dissertation of Gregor Dudek certainly is one such valuable source because it tackles inter-organizational collaboration in a novel and effective manner.

SCM is concerned with the coordination of material, information and financial flows within and across often legally separated organizational units. It has gained great attention both in industry and research as an important area for improving competitiveness. A Supply Chain (SC) can be regarded as a hybrid between a market relationship and a hierarchical organization and as such requires specific tools to support the efficient planning and execution of the order fulfillment process.

Software vendors have developed so called Advanced Planning Systems (APS) to overcome deficiencies of traditional Enterprise Resource Planning systems and to better support the planning functions needed in SCM. However, APS are based on the principles of hierarchical planning which are well-suited for intra-organizational SCs but fall short when non-hierarchical collaboration between partners (companies) is needed. This is particularly true when a buyer and a supplier have to align their medium term order and supply plans.

This is the starting point of the dissertation of Gregor Dudek. He devises a negotiation-based collaborative planning scheme that coordinates master plans of two individual SC partners each with his own planning domain (APS). Extensions to more general two tier SC structures are provided too. The basic idea of the negotiation scheme is that order proposals (generated by buyers) and supply proposals (generated by suppliers) are exchanged between SC partners in an iterative manner. The proposal received from a SC partner is analyzed for its consequences on local (master) planning, and a counter-proposal is generated by introducing partial modifications. Resulting is a negotiation-based process which subsequently improves SC wide costs without centralized decision making and with limited exchange of information between the partners. Specifically, only the respective order / supply proposals and associated cost effects are exchanged between SC partners.

As a generic model for master planning – although not limited to it - a multi-level, capacitated, lot-sizing model (MLCLSP) is assumed. The MLCLSP is then enlarged by additional variables and constraints to mimic the specific tasks of the model in the negotiation process. Here, the generation of a compromise proposal – along the lines of Goal Programming – has to be mentioned as one of the novel features of Dudek's research.

Several valuable extensions to the basic negotiation scheme are discussed, like rolling schedules or possible compensation schemes in light of psychological experiments, contract theory, game theory, controlling and common sense.

Extensive computational tests show that the proposed negotiation scheme results in less SC wide costs than achievable by pure upstream planning and even

comes near to the minimum cost solutions of central planning after only a few (i.e. about five) iterations.

In summary Gregor Dudek has developed a negotiation scheme for coordinating master plans between SC partners which

- avoids the exchange of critical information like cost and capacities, i.e. only uses (uncritical) order and supply proposals by partners,
- comes near to the minimum cost of central planning,
- and requires only a few negotiation rounds (iterations).

Since the proposed negotiation scheme can already be applied by SC partners today by making use of APS and existing Collaborative Planning modules research results of this dissertation will have a great impact on the theory and practice of SCM. The extraordinary quality of his contribution has also been acknowledged by the jury of the Management Science Strategic Innovation Prize (MSSIP) by ranking a related paper as the second best among all submitted publications in the 2003 contest.

Darmstadt, August 2003

Hartmut Stadler

Preface

The following dissertation is the outcome of a three-year research effort at the department of Production and Supply Chain Management of the Darmstadt University of Technology.

When this work started in summer 2000, the term “Collaborative Planning” was about to gain popularity, especially in practitioner-oriented publications on Supply Chain Management. Yet, in searching these publications for answers to questions of how a Collaborative Planning process should actually look like, or which goals and objectives it should serve, one quickly found that most contributions only scratched at the surface of the idea of Collaborative Planning. Most frequently, discussions focused on technological means available for the exchange of information between independent Supply Chain partners, such as Email, Web-interfaces, or the XML technology.

While the technological perspective is an important aspect, it is by itself not sufficient to realize a Collaborative Planning process. Therefore, the goal of this dissertation is to provide a process model which is concerned with the decision making and negotiation aspects of Collaborative Planning. Taking necessary technological means as a given, it sketches a detailed picture of a Collaborative Planning process at the medium-term level of Master Planning, and indicates how financial and contractual aspects are affected by the negotiations of supply quantities between buyers and suppliers.

This work could not have been realized without help and guidance of numerous supporters. First and foremost, I like to thank my adviser Hartmut Stadtler. He not only proposed the topic of the dissertation as a potential gap in existing research on Supply Chain Management, but also gave crucial advice throughout all stages of the work. I am also very thankful to Ton de Kok from the Eindhoven University of Technology for his willingness to serve as the co-adviser and second referee of the dissertation. His general interest in the work along with numerous hints and comments helped to improve the quality of the dissertation substantially.

Equally important for the progress of the project were the steady debates and discussions with colleagues and co-workers. I especially like to thank Jens Rohde and Christopher Sürle from the Darmstadt University of Technology as well as Norbert Wenig from the SAP AG.

Finally, I am indebted to my family and friends for their support and encouragement on the one hand, but also for their constant reminds that there is a live beyond purely scientific matters. This applies in the first place to my girl friend Natalie Kappesser. Although actually practicing pediatrics, she not only accepted to become a Supply Chain expert in her own right, but also managed unambiguously to keep my feet on the ground.

Mainz, August 2003

Gregor Dudek

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